

An Electrical Capacitance Tomography Based Soot Load Estimation Method for a Diesel Particulate Filter

Ragibul Huq* and Sohel Anwar**

*Graduate Student **Associate Professor
Mechatronics Research Laboratory
Department of Mechanical Engineering
Purdue School of Engineering and Technology, IUPUI

This research presents a novel approach of Particulate Material (soot) measurement in a Diesel particulate filter using Electrical Capacitance Tomography. Modern Diesel Engines are equipped with Diesel Particulate Filters (DPF's), as well as on-board technologies to evaluate the status of DPF because complete knowledge of DPF soot loading is very critical for robust efficient operation of the engine exhaust after treatment system. Emission regulations, getting stringent day by day, imposed upon all internal combustion engines, including Diesel engines on gaseous as well as particulates (soot) emissions by Environment Regulatory Agencies. In course of time, soot will be deposited inside the DPFs which tend to clog the filter and hence generate a back pressure in the exhaust system, negatively impacting the fuel efficiency. To remove the soot build-up, regeneration (active or passive) of the DPF must be done as an engine exhaust after treatment process at pre-determined time intervals. Since the regeneration process consume fuel, a robust and efficient operation based on accurate knowledge of the particulate matter deposit (or soot load) becomes essential in order to keep the fuel consumption at a minimum. In this paper, we propose a sensing method for a DPF that can accurately measure in-situ soot load using Electrical Capacitance Tomography (ECT). Simulation results show that the proposed method offers an effective way to accurately estimate the soot load in DPF. A hardware-in-loop bench has been built in the Mechatronics Research Lab at IUPUI to further develop this sensing concept and experimentally verify the associated measurement technology. Preliminary experimental data is very promising. This poster will present this novel sensing concept and some of the experimental results that support this technology. A patent application has been filed on this technology by IURTC in January, 2014. The proposed method is expected to have a profound impact in improving overall PM filtering efficiency (and thereby fuel efficiency), and durability of a Diesel Particulate Filter (DPF) through appropriate closed loop regeneration operation.